YELLOW FEVER INSTITUTE, BULLETIN No. 11.

Treasury Department, Public Health and Marine-Hospital Service.

WALTER WYMAN, Surgeon-General.

VESSELS AS CARRIERS OF MOSQUITOES,

BY

Passed Asst. Surg. S. B. GRUBBS.

MARCH, 1903.

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Section C.—TRANSMISSION. Asst. Surg. Gen. J. H. WHITE, Chairman of Section.

VESSELS AS CARRIERS OF MOSQUITOES.

By S. B. GRUBBS,

Passed Assistant Surgeon, United States Public Health and Marine-Hospital Service.

At the present time, when evidence is pointing with more and more clearness to the mosquito as the sole means of transmitting yellow fever, nothing is of greater interest to the quarantine officer than to decide to what extent and under what circumstances these infecting insects may be carried by vessels.

This subject may be approached in three different ways: First, by observations on the length of time after leaving infected ports vessels may develop yellow fever; second, by experiments with mosquitoes under artificial conditions made to simulate as much as possible those of nature; and third, by actual observation of vessels arriving from ports at the time infected or where the presence of the *Stegomyia fasciata* render them liable to infection.

While it will require data obtained by all these means and extending over a long period to arrive at any conclusions sufficiently accurate to allow them to influence quarantine procedure, still I believe the last method of observation cited will throw more light on the subject than the first two.

It is for this reason that every vessel arriving at Gulf Quarantine Station from Stegomyia-infected ports has, since the 1st of July last, been carefully examined to ascertain if mosquitoes were present on board, and, if present, their variety, where and when they came aboard, and under what conditions.

Gulf Quarantine Station is an especially good point for these observations, from the fact that it is 10 miles from the mainland, and because vessels bound here do not pass near land, and so but rarely take on mosquitoes en route, and even these, as will be seen, are

always the marsh-bred varieties of *Culex*. Besides, the examination of at least a thousand mosquitoes on Ship Island has convinced me that there are no *Stegomyia* here.

Each vessel inspected was carefully searched, the inspector being armed with a cyanide killing bottle, and in addition the captain was asked the following questions:

1. Were there any mosquitoes on board on your outward voyage, consisting of —— days?

2. If so, did they come aboard before departure from home port or at sea, and under what circumstances?

3. Were there any mosquitoes on board at your destination or on homeward voyage?

4. If in port—

(*a*) How far were you from shore?

(*b*) Prevailing wind and weather?

5. If on homeward voyage (consisting of —— days)—

(*a*) Were they from port?

(*b*) Did they come aboard at sea, on what day, and how far were you from land?

(*c*) Were there wigglers in any of your tanks at any time?

During the five months from June 1 to November 1 observations were made on 82 vessels, all arriving from ports where the *Stegomyia* is believed to exist in quantities. Of these 78 were sailing vessels and 4 were steamers.

Of these 82 vessels 65 claimed to have had no mosquitoes aboard at any time during the voyage or at port of departure, and their absence having been confirmed by search, we can dismiss them from consideration and pass to the remaining 17.

Five of these had mosquitoes on board at their ports of departure, 2 being rid of them as soon as they were well at sea, while 3 others carried them two days and were then no more troubled, except one schooner on which they reappeared in quantities five days before she reached this port, when she was 20 miles from shore.

Nine sailing vessels, having no mosquitoes on board before sailing, had them appear at sea, in one case from the water casks in which the captain found larvæ. But in the other cases they doubtless came from land which was at the time distant—20 miles in one case, 15 miles in three cases, 10 miles in one case, and 2 miles in the last two instances. In all these vessels the mosquitoes found on board on arrival at this station were the common varieties of *Culex*, there being no *Anopholes* or *Stegomyia* among them.

Stegomyia fasciata were found on board and were identified in the remaining three cases, as follows:

The schooner *Susie B. Dantzler* arrived from Vera Cruz, Mexico, on July 16, 1902, after a voyage of fifteen days. The captain stated

that mosquitoes came aboard in large quantities at Vera Cruz, although he lay a half mile from shore and there were variable winds with squalls and rain all the time. The number of the insects decreased on the voyage but were always in evidence, and we caught four or five of them here. No larvæ were found in any of the tanks, and as the captain had repeatedly examined them without result in his efforts to be rid of the mosquitoes, I believe the insects found on board here came all the way from Vera Cruz.

The schooner *Eleanor* arrived from Vera Cruz on July 17, 1902, thirteen days out. She had no mosquitoes on board before reaching Vera Cruz, but there quantities came on board. Her moorings were half a mile from shore and the winds were variable. The captain stated that he could not get rid of the insects after sailing, although the number decreased very much and there were no larvæ in any of the tanks. At the time of her inspection here we caught and identified a number of *Stegomyia*.

The brigantine *John H. Crandon* arrived at the station July 27, 1902, twenty-two days from Vera Cruz, where she had one case of yellow fever on board. At that port she lay a half mile from the sea wall, three-eighths of a mile from an infected prison, and within 200 yards of an infected vessel. *Stegomyia fasciata* were found on board by Acting Assistant Surgeon Hodgson before she sailed, as well as larvæ in the tanks. All during the trip there were mosquitoes in abundance, and a veritable plague of *Stegomyia* was found on board on her arrival here. There was a constant buzz in the forecastle, and anyone entering was sure to be attacked by several mosquitoes. Specimens were caught in almost every protected part of the vessel, and all were found to be the *Stegomyia fasciata*. The captain had emptied several water barrels because he found they were breeding mosquitoes, but the water remaining had no live larvæ, although many old moults were seen. As breeding was surely going on in the tanks during a part of the voyage at least, it would be impossible to say how long any particular mosquito had been aboard or if any of them had been brought here from the infected port.

SUMMARY.

The above facts may be summed up as follows:

Vesssels having no mosquitoes on board at any time	65
Vessels having mosquitoes on board in port of departure	5
Vessels on which mosquitoes (*Culex*) appeared en route	9
Vessels arriving with *Stegomyia fasciata* on board	3

Three and a half per cent, then, of all vessels brought *Stegomyia* on a voyage averaging seventeen days.

CONCLUSIONS.

From but one season's observations at a single quarantine station we can not assume to draw any hard and fast conclusions regarding the probability of *Stegomyia*, infected or not, being carried by vessels. Nevertheless, I think we may conclude, first, that mosquitoes can come aboard vessels under favorable conditions when the vessel is not over 15 miles from shore; second, that *Stegomyia* can be carried from Mexican or West Indian ports to those of our Gulf States; third, that they can board a vessel lying at anchor a half mile or less from shore, being conveyed by the open lighters used or flying aboard, and finally, that a vessel moored a short distance from land may become infected with yellow fever, our old beliefs to the contrary notwithstanding.

I wish to acknowledge the aid of Assistant Surgeons Burkhalter and Ebersole in collecting data and specimens.

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